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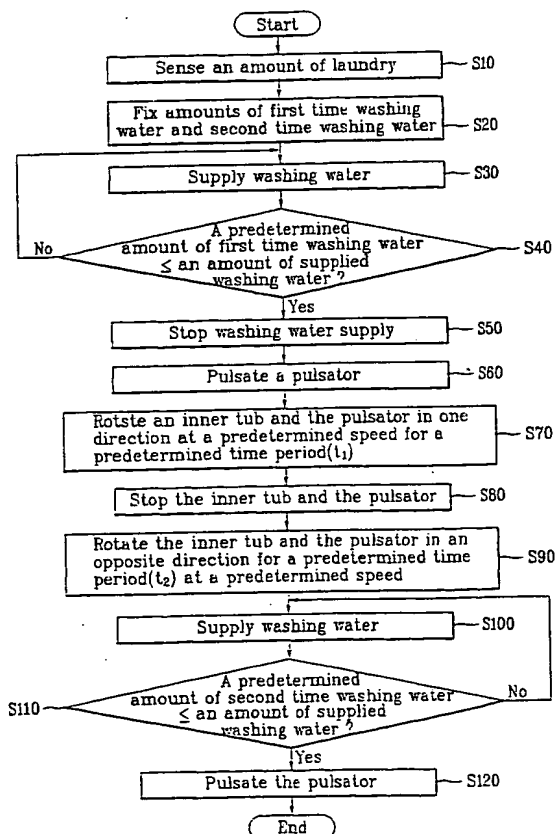
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(54) Title: WASHING METHOD FOR WASHING MACHINE



(57) Abstract: Method for washing laundry in a washing machine, including the steps of supplying predetermined amounts of washing water and detergent to an outer tub and an inner tub in the outer tub for holding laundry according to an amount of the laundry, and rotating the inner tub and a pulsator in the inner tub at a predetermined speed by a motor, to wash the laundry by a centrifugal force, whereby permitting quick detergent dissolution and laundry wetting, and circulating the laundry, smoothly.

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## WASHING METHOD FOR WASHING MACHINE

### Technical Field

The present invention relates to methods for washing laundry in a washing machine, and more particularly, to a method for washing laundry in a washing machine  
5 for washing laundry with centrifugal force.

### Background Art

In general, the washing machine removes dirt stuck to laundry by washing water, chemical reaction of detergent, and mechanical action like friction and vibration.

The washing machine is provided with a cabinet forming an outer appearance  
10 of washing machine, an outer tub inside of the cabinet for holding washing water, an inner tub rotatably mounted on an inside of the outer tub, for holding and washing laundry, a pulsator rotatably mounted on a bottom of the inner tub, for circulating the washing water in the inner tub, and a motor under the outer tub connected to the inner tub and the pulsator for rotating either the inner tub or the pulsator.

15 There are a water supply valve assembly having a water supply valve, and a detergent box assembly in an upper part of the cabinet, for supplying the washing water and detergent to the inner tub, and there is a drain valve assembly below the outer tub for draining the washing water.

The motor is designed to transmit power only to a washing shaft which  
20 connects the pulsator and the motor, or both to a spinning shaft connected to the inner tub and the washing shaft at the same time. For this, there is a clutch over the motor for connecting the washing shaft and the spinning shaft to transmit the motor power both to the washing shaft and the spinning shaft at the same time.

A related art method for washing laundry in a washing machine will be  
25 described.

First, an amount of laundry is sensed as the pulsator pulsates in a state the laundry is introduced into the inner tub, and an amount of washing water is supplied to the inner tub together with detergent through the water supply valve assembly and the detergent box assembly according to the sensed amount of laundry for initial washing.

5       Next, only the pulsator connected to the washing shaft is rotated for a preset time period by the motor in a state the washing water and the detergent is supplied to the inner tub, for dissolving the detergent in the washing water and, at the same time with this, wetting the laundry with the washing water.

10       If the inner tub is supplied with the washing water more than the amount of washing water required for the initial washing according to the sensed amount of laundry, the pulsator is rotated to make a final washing.

15       However, the related art method for washing laundry in a washing machine takes a long period of time in dissolving the detergent and wetting the laundry because the detergent dissolving and the laundry wetting are made only by rotating the pulsator in a state a comparatively small amount of washing water required for initial washing is supplied.

20       Moreover, if the laundry is introduced into the inner tub in a state the laundry is spread on the pulsator, the laundry rotates together with the pulsator in the initial washing to fail in making a mechanical friction, resulting in drop of a washing performance.

#### Disclosure of the Invention

25       An object of the present invention designed to solve the foregoing problems is to provide a method for washing laundry in a washing machine, which can make detergent dissolution and laundry wetting quickly in a state washing water is supplied to a preset first time water level to an inner tub and an outer tub according to an amount of

laundry, and laundry circulation smoothly.

Other object of the present invention is to provide a method for washing laundry in a washing machine, in which a pulsator and an inner tub rotate in one or the other direction at the same time depending on power input to a motor, to wash laundry by a centrifugal force, and the motor stops quickly at the moment of reversal of the inner tub and the pulsator, for reducing a washing time period.

The object of the present invention can be achieved by providing a method for washing laundry in a washing machine, including the steps of supplying predetermined amounts of washing water and detergent to an outer tub and an inner tub in the outer tub for holding laundry according to an amount of the laundry, and rotating the inner tub and a pulsator in the inner tub at a predetermined speed by a motor, to wash the laundry by a centrifugal force.

The step of supplying washing water and detergent includes the steps of fixing an amount of a first time washing water, and an amount of second time washing water greater than the amount of the first time washing water according to the amount of the laundry, and supplying the washing water to the inner tub as much as the amount of the first time washing water.

The step of supplying the washing water and the detergent includes the step of rotating the pulsator for mixing supplied washing water and the detergent with the laundry.

In the step of supplying washing water and detergent, the pulsator repeats one or the other direction rotation alternately for a predetermined number of times.

The step of washing laundry includes the steps of rotating the inner tub and the pulsator in one direction, stopping the inner tub and the pulsator, and rotating the inner tub and the pulsator in an opposite direction.

The step of stopping the inner tub and the pulsator includes the step of turning on/off power supplied to the motor for a preset time period to rotate the motor in a rotation direction opposite to the rotation direction of the motor in the step of rotating the inner tub and the pulsator in one direction.

5       The step of washing laundry further includes the steps of the washing water penetrating the laundry by a centrifugal force generated by rotation of the inner tub and the pulsator, and the washing water rising along an inside wall of the outer tub, and introduced into the inner tub from a top of the inner tub.

10       The step of washing laundry further includes the steps of the washing water penetrating the laundry pushed onto an inside wall of the inner tub by a centrifugal force generated by rotation of the inner tub and the pulsator, and stopping the inner tub and the pulsator, to let the laundry fall down onto the pulsator.

The step of washing laundry further includes the step of rotating the pulsator for washing the laundry by pulsation of the pulsator.

15       The step of rotating the pulsator includes the step of rotating the inner tub having no rotation force of the motor transmitted thereto together with the rotation of the pulsator in a direction opposite to the rotation direction of the pulsator by a principle of action-reaction with respect to the rotation of the pulsator.

In other aspect of the present invention, there is provided a method for washing  
20       laundry in a washing machine, including the steps of supplying predetermined amounts of washing water and detergent to an outer tub and an inner tub in the outer tub for holding laundry, according to an amount of the laundry, rotating a pulsator for mixing the supplied washing water and the detergent with the laundry, and washing the laundry by a centrifugal force including the steps of rotating the inner tub and the pulsator in the  
25       inner tub in one direction at a predetermined speed by a motor, stopping the inner tub

and the pulsator, and rotating the inner tub and the pulsator in an opposite direction at a predetermined speed by the motor.

The step of stopping the inner tub and the pulsator includes the step of turning on/off power supplied to the motor for a preset time period to rotate the motor in a rotation direction opposite to the rotation direction of the motor in the step of rotating the inner tub and the pulsator in one direction.

The step of rotating the inner tub and the pulsator before or after the step of stopping the inner tub and the pulsator includes the step of the washing water penetrating the laundry by a centrifugal force generated by rotation of the inner tub and the pulsator, and the washing water rising along an inside wall of the outer tub, and introduced into the inner tub from a top of the inner tub.

The step of rotating the inner tub and the pulsator before or after the step of stopping the inner tub and the pulsator includes the step of the washing water penetrating the laundry pushed onto an inside wall of the inner tub by a centrifugal force generated by rotation of the inner tub and the pulsator, and stopping the inner tub and the pulsator, to let the laundry fall down onto the pulsator.

The step of washing the laundry is made by repeating one or the other direction rotation of the inner tub and the pulsator for a predetermined number of times.

The step of rotating the laundry further includes the step of rotating the pulsator to wash the laundry by pulsation of the pulsator after repetition of the one or the other direction rotation of the inner tub and the pulsator for a predetermined number of times.

The step of rotating the pulsator includes the step of rotating the inner tub having no rotation force of the motor transmitted thereto together with the rotation of the pulsator in a direction opposite to the rotation direction of the pulsator by a principle of action-reaction with respect to the rotation of the pulsator.

### Brief Description of Drawings

The accompanying drawings, which are included to provide a further understanding of the invention, and illustrate an embodiment of the invention.

In the drawings;

5        FIG. 1 illustrates a section of an example of a washing machine in which laundry is washed by a method for washing laundry in a washing machine in accordance with a preferred embodiment of the present invention; and

10        FIG. 2 illustrates a flow chart showing the steps of a method for washing laundry in a washing machine in accordance with a preferred embodiment of the present invention.

### Best Mode for Carrying Out the Invention

Reference will now be made in detail to the preferred embodiment of the present invention, examples of which are illustrated in the accompanying drawings. In describing the embodiment, identical parts will be given the same names and reference  
15        symbols, and additional or repetitive description of which will be omitted.

FIG. 1 illustrates a section of an example of a washing machine in which laundry is washed by a method for washing laundry in a washing machine in accordance with a preferred embodiment of the present invention, and FIG. 2 illustrates a flow chart showing the steps of a method for washing laundry in a washing machine  
20        in accordance with a preferred embodiment of the present invention.

Referring to FIG. 1, the washing machine includes a cabinet 2 forming an outer appearance of the washing machine, an outer tub 4 inside of the cabinet for holding washing water, an inner tub 6 rotatably mounted on an inside of the outer tub having a perforated wall for pass of the washing water, for holding the washing water and laundry, a pulsator 8 rotatably mounted on a bottom of the inner tub 4, for circulating the  
25



washing water in the inner tub 6, and a motor 10 under the outer tub 4 for rotating the inner tub 6 and the pulsator 8.

The motor 10 may be a BLDC motor which can sense an operation state for itself, and can brake electrically, or an induction motor which is less expensive than the BLDC motor.

The motor is designed to transmit rotation force only to the pulsator 8, or both to the pulsator and the inner tub at the same time, for rotating the pulsator 8 and the inner tub 6 in the same direction.

For this, there is a washing shaft 8a between the motor and the pulsator 8, having a lower end connected to the motor 10, and an upper end connected to the pulsator 8, for transmitting a rotation force of the motor 10 to the pulsator. There is a spinning shaft 6a having one end connected to a center of under side of the inner tub 6, and the other end connected to the washing shaft 8a by a clutch (not shown) for transmitting the rotation force from the motor 10 received through the washing shaft 8a to the inner tub 6, selectively.

There are a water supply valve assembly 12, and a detergent box assembly 14 at one side of an upper part of the cabinet 2, for supplying washing water and detergent to the outer tub 4 and the inner tub 4, and there is a drain valve assembly 16 at one side of under side of the outer tub for draining the washing water from the outer tub 4 and the inner tub 6 to an outside of the cabinet.

There are an annular auto-balancing mechanism at a top of the inner tub 6 for maintaining balancing of the inner tub to prevent the inner tub 6 from hitting the outer tub 4 due to eccentricity of the laundry, and an annular outer tub cover 4a at a top of the outer tub 4 for blocking the washing water rising along an inside wall of the outer tub 4 due to centrifugal force during rotation of the inner tub 6.

A method for washing laundry in a washing machine in accordance with a preferred embodiment of the present invention will be described with reference to FIGS. 1 and 2.

Referring to FIGS. 1 and 2, the method for washing laundry in a washing machine includes the step of sensing an amount of laundry introduced into the inner tub 6, and supplying a predetermined amount of water to the inner tub 6 according to the sensed amount of laundry, and the step of driving a motor 10 to wash the laundry.

In more detail, when the laundry is introduced into the inner tub 6, and power is supplied to the washing machine, the pulsator 8 is rotated to sense an amount of the laundry (S10), and fix an amount of washing water in proportion to the amount of laundry (S20).

In more detail, in a state the engagement between the clutch and the washing shaft 8a is released, the motor 10 transmits one or the other direction rotation force to the pulsator 8 only with the washing shaft 8a, to rotate the pulsator 8. Next, upon turning off power to the motor 10, the amount of laundry is sensed according to a number of pulses generated by inertia of the motor 10.

Upon sensing the amount of laundry, the amount of washing water is fixed according to the amount of laundry. In this instance, the amount of washing water is fixed for a first time amount of washing water, and a second time amount of washing water which is greater than the first time amount of washing water (S20).

Though the first time amount of washing water may be fixed in a variety of methods, as an example of the first time amount of washing water, the first time amount of washing water may be a minimum amount that can submerge the laundry, or a maximum amount that can not submerge the laundry. The second time amount of washing water may be an amount that can submerge the laundry adequately, or in more

detail, a preset times of the first time amount of washing water. It is preferable that an amount of the detergent is also fixed in the step of fixing the amount of the washing water, for dissolving in the washing water to remove contaminants stuck to the laundry by chemical action.

5        Upon fixing the amounts of the washing water and the detergent to be supplied to the inner tub 6 according to the amount of the laundry, the water supply valve is opened, to supply the washing water until the washing water reaches to the first time amount of washing water through the water supply valve assembly 12 (S30, and S40). Of course, a predetermined amount of detergent is also supplied to the inner tub 6 in  
10    above process.

The amount of washing water supplied to the inner tub 6 is sensed at the water supply sensor, and when the washing water is supplied to a preset level, the water supply valve is closed, to stop the supply of washing water (S50).

When the supply of washing water is stopped thus (S50), the motor 10 rotates  
15    the pulsator 8 only, for detergent dissolution and the laundry wetting by the pulsation (S60) of the pulsator 8.

In more detail, in a state the clutch is not engaged with the washing shaft 8a, the motor 10 transmits one or the other direction of rotation force to the pulsator 8 only with the washing shaft 8a as a polarity of input power is changed, to rotate the pulsator  
20    8 in one or the other direction alternately for a predetermined time period and a predetermined number of times repeatedly, to dissolve the detergent in the washing water held in the inner tub 6 uniformly and to wet the laundry in the washing water having the detergent dissolved therein by the pulsation of the pulsator 8.

Next, the laundry is washed by a centrifugal force generated when the motor 10  
25    rotates the inner tub 6 and the pulsator 8 in one direction.

In more detail, upon finishing the step of pulsation by the pulsator 8, the clutch connects the washing shaft 8a and the spinning shaft 6a, so that the motor 10 rotates the inner tub 6 and the pulsator in one direction for a predetermined time period t1 at a predetermined speed, simultaneously (S70). As the inner tub 6 and the pulsator are rotated by the motor 10 simultaneously, the laundry is pushed onto an inside wall of the inner tub 6 by the centrifugal force, and the washing water repeats a process by the centrifugal force, in which the washing water penetrates through the laundry, is discharged to the outer tub through the perforation in the inner tub, rises along the inside wall of the outer tub 4, hits the outer tub cover 4a, and is introduced into the inner tub from the top of the inner tub 6.

If the predetermined time period t1 is passed after rotation of the inner tub 6 and the pulsator 8 are started, the inner tub 6 and the pulsator 8 stop temporarily. In a course of stopping of the inner tub 6 and the pulsator 8, the laundry pushed onto the inside wall of the inner tub 6 falls down onto the pulsator 8, to provide a mechanical friction to the laundry.

The step of stopping the inner tub 6 and the pulsator 8 will be described in more detail. After the washing is preformed for the predetermined time period t1 by the one direction rotation of the inner tub 6 and the pulsator 8, the motor 10 is braked as power to the motor 10 is turned on/off to rotate the motor 10 in an opposite direction, to stop the inner tub 6 and the pulsator 8 (S80).

In other words, in a state the washing shaft 8a is rotating in one direction by inertia of the motor 10, by supplying power to the motor while changing a polarity of the power at fixed intervals repeatedly, for making the washing shaft 8a to rotate in an opposite direction, to offset the inertia of the motor 10, the inner tub 6 and the pulsator 8 stop completely (S80).

Since the present invention includes the braking step, a time period required for stopping the inner tub 6 and the pulsator 8 completely can be reduced, thereby reducing an overall washing time period.

When the inner tub 6 and the pulsator 8 stop, as described before, the laundry  
5 pushed to the inside wall of the inner tub 6 by the centrifugal force drops onto the pulsator 8, to provide an effect of washing by rubbing the laundry on the pulsator 8 and the inner tub 6.

As the washing water circulates smoothly by the centrifugal force following rotation of the inner tub 6 and the pulsator 8 in a state the first time washing water is  
10 supplied to the inner tub 6 and the pulsator 8, the detergent dissolution and the laundry wetting is made quickly, and, even if the laundry is introduced into the inner tub 6 in a state the laundry is spread on the pulsator 8, the laundry moves toward the inside wall of the inner tub 6 by the rotation of the inner tub 6 and the pulsator 8.

Next, the second time washing is made by the centrifugal force as power is  
15 supplied to the motor 10 such that the motor 10 rotates the pulsator 8 and the inner tub 6 in an opposite direction.

In more detail, the motor 10 rotates the inner tub 6 and the pulsator 8 at the same time in an opposite direction for a predetermined time period  $t_2$  at a predetermined speed ( $S_{90}$ ). As the inner tub 6 and the pulsator 8 rotate in the opposite  
20 direction of the foregoing rotation direction at the same time, the laundry is pushed onto the inner tub 6 by the centrifugal force, and the washing water repeats a process by the centrifugal force for the predetermined time period  $t_2$ , in which the washing water penetrates through the laundry, is discharged to the outer tub through the perforation in the inner tub, rises along the inside wall of the outer tub 4, hits the outer tub cover 4a,  
25 and is introduced into the inner tub from the top of the inner tub 6.

If the predetermined time period  $t_2$  is passed, the inner tub 6 and the pulsator 8 stop, and the laundry pushed onto the inside wall of the inner tub 6 falls down onto the pulsator 8.

If the inner tub 6 and the pulsator 8 stop, the washing water is supplied to the inner tub 6 again (S100), until the washing water reaches to the preset amount of the second time washing water, when the supply of the washing water stops (S110), and the washing is made as the pulsator 8 is rotated by the motor 10 (S120). Of course, in the step of supplying the washing water, a predetermined amount of the detergent may also be supplied additionally. Since the step of sensing a supplied amount of the second time washing water, and stopping the supply is the same with the step of supplying the first time washing water, description of which will be omitted.

The washing by pulsation of the pulsator 8 is made as the motor 10 rotates only the pulsator 8 in one/the other direction alternately in a state the clutch is not engaged with the washing shaft 8a and the spinning shaft 6a. However, in the pulsator 8 rotating step, along with the rotation of the pulsator 8, the inner tub may rotate in an opposite direction of the rotation direction of the pulsator 8 by the principle of action-reaction.

Because the effect of washing by rubbing the laundry is provided by the mechanical friction occurred as the laundry hits the inner tub 6 and the pulsator 8 owing to the pulsation caused by the rotation of the pulsator 8, and the smooth circulation of the laundry in the inner tub following circulation of the washing water permit to improve a washing performance.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of

the appended claims and their equivalents.

#### Industrial Applicability

As has been described, the present invention provides a method for washing laundry in a washing machine including the step of washing laundry by rotating the inner tub and the pulsator together in the same direction in a state predetermined washing water and detergent is supplied, and stopping the rotating inner tub and the pulsator quickly.

Accordingly, the method for washing laundry in a washing machine of the present invention permits to improve a washing performance because the detergent dissolution and the laundry wetting is made quickly owing to one direction simultaneous rotation of the pulsator and the inner tub in a state a predetermined amount of the washing water preset according the amount of laundry introduced into the inner tub is supplied.

Since the quick braking of the motor is possible by controlling an input power to the motor at reversal of rotation direction of the pulsator and the inner tub even if a comparatively low price induction motor is applied to the washing machine, a production cost of the washing machine can be reduced.

Moreover, the method for washing laundry in a washing machine of the present invention permits, not only reduction of a washing time period, but also enhance operation reliability of the motor, because the rotation direction of the inner tub and the pulsator can be reversed by controlling an input power to the motor to stop the inner tub and the pulsator quickly in the step of reversing the rotation direction of the inner tub and the pulsator.

What is Claimed is:

1. A method for washing laundry in a washing machine, comprising the steps of:

supplying predetermined amounts of washing water and detergent to an outer  
5 tub and an inner tub in the outer tub for holding laundry according to an amount of the laundry; and

rotating the inner tub and a pulsator in the inner tub at a predetermined speed by a motor, to wash the laundry by a centrifugal force.

10 2. The method as claimed in claim 1, wherein the step of supplying washing water and detergent includes the steps of;

fixing an amount of a first time washing water, and an amount of second time washing water greater than the amount of the first time washing water according to the amount of the laundry, and

15 supplying the washing water to the inner tub as much as the amount of the first time washing water.

3. The method as claimed in claim 1, further comprising the step of rotating the pulsator for mixing the supplied washing water and the detergent with the laundry  
20 between the step of supplying washing water and detergent and the step of washing the laundry.

4. The method as claimed in claim 3, wherein, in the step of supplying washing water and detergent, the pulsator repeats one or the other direction rotation alternately  
25 for a predetermined number of times.



5. The method as claimed in claim 1, wherein the step of washing laundry includes the steps of;

rotating the inner tub and the pulsator in one direction,

5 stopping the inner tub and the pulsator, and

rotating the inner tub and the pulsator in an opposite direction.

6. The method as claimed in claim 5, wherein the step of stopping the inner tub and the pulsator includes the step of turning on/off power supplied to the motor for a  
10 preset time period to rotate the motor in a rotation direction opposite to the rotation direction of the motor in the step of rotating the inner tub and the pulsator in one direction.

7. The method as claimed in claim 1, wherein the step of washing laundry  
15 further includes the steps of;

the washing water penetrating the laundry by a centrifugal force generated by rotation of the inner tub and the pulsator, and

the washing water rising along an inside wall of the outer tub, and introduced into the inner tub from a top of the inner tub.

20

8. The method as claimed in claim 1, wherein the step of washing laundry further includes the steps of;

the washing water penetrating the laundry pushed onto an inside wall of the inner tub by a centrifugal force generated by rotation of the inner tub and the pulsator,

25 and

stopping the inner tub and the pulsator, to let the laundry fall down onto the pulsator.

9. The method as claimed in claim 1, wherein the step of washing laundry  
5 further includes the step of;

rotating the pulsator for washing the laundry by pulsation of the pulsator.

10. The method as claimed in claim 1, wherein the step of rotating the pulsator  
includes the step of rotating the inner tub having no rotation force of the motor  
10 transmitted thereto together with the rotation of the pulsator in a direction opposite to  
the rotation direction of the pulsator by a principle of action-reaction with respect to the  
rotation of the pulsator.

11. A method for washing laundry in a washing machine, comprising the steps  
15 of:

supplying predetermined amounts of washing water and detergent to an outer  
tub and an inner tub in the outer tub for holding laundry, according to an amount of the  
laundry;

rotating a pulsator for mixing the supplied washing water and the detergent with  
20 the laundry; and

washing the laundry by a centrifugal force including the steps of;

rotating the inner tub and the pulsator in the inner tub in one direction at a  
predetermined speed by a motor,

stopping the inner tub and the pulsator, and

25 rotating the inner tub and the pulsator in an opposite direction at a

predetermined speed by the motor.

12. The method as claimed in claim 11, wherein the step of stopping the inner tub and the pulsator includes the step of turning on/off power supplied to the motor for a  
5 preset time period to rotate the motor in a rotation direction opposite to the rotation direction of the motor in the step of rotating the inner tub and the pulsator in one direction.

13. The method as claimed in claim 11, wherein the step of rotating the inner  
10 tub and the pulsator before or after the step of stopping the inner tub and the pulsator includes the step of;

the washing water penetrating the laundry by a centrifugal force generated by rotation of the inner tub and the pulsator, and

the washing water rising along an inside wall of the outer tub, and introduced  
15 into the inner tub from a top of the inner tub.

14. The method as claimed in claim 11, wherein the step of rotating the inner tub and the pulsator before or after the step of stopping the inner tub and the pulsator includes the step of;

20 the washing water penetrating the laundry pushed onto an inside wall of the inner tub by a centrifugal force generated by rotation of the inner tub and the pulsator, and

stopping the inner tub and the pulsator, to let the laundry fall down onto the pulsator.

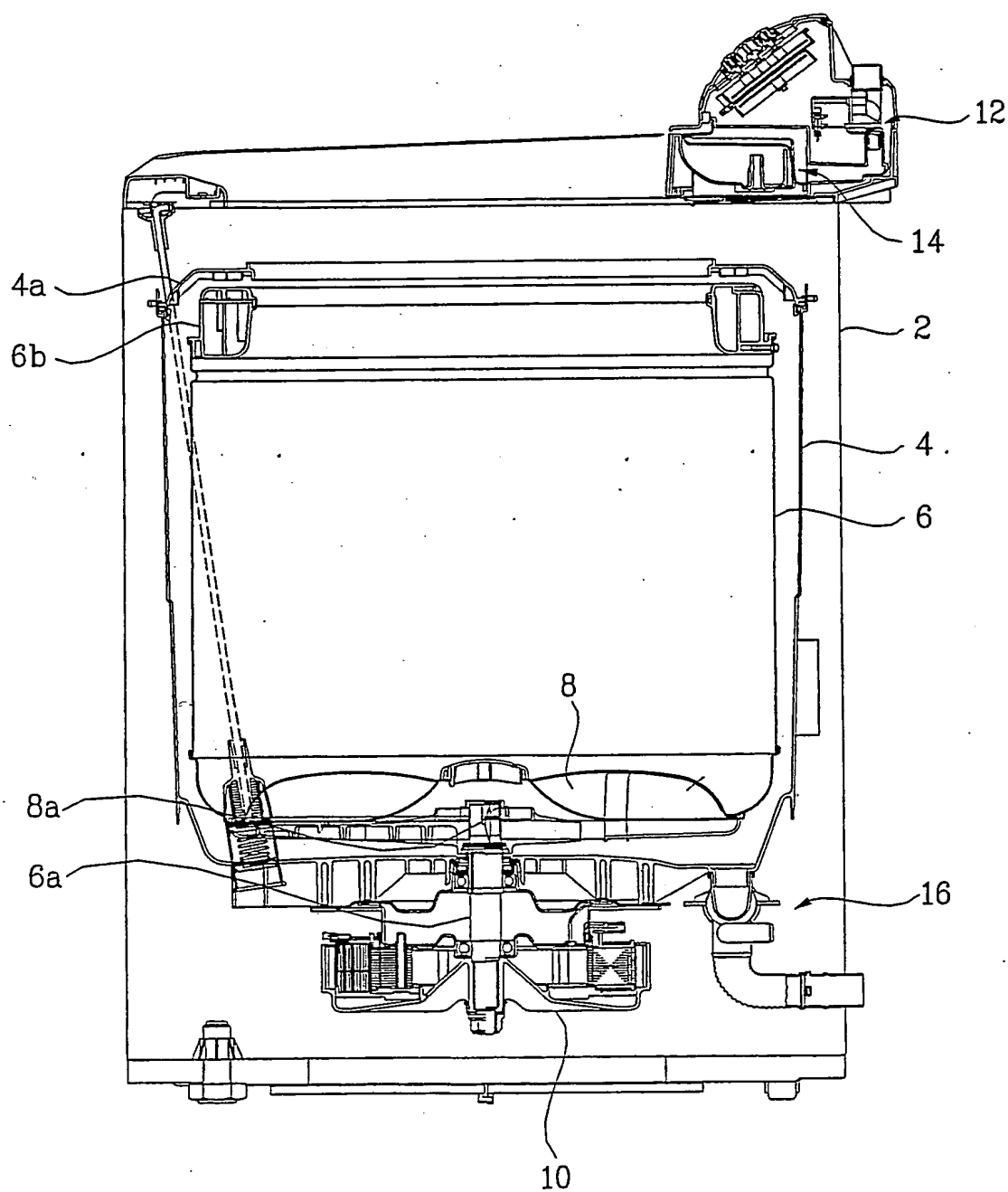
15. The method as claimed in claim 11, wherein, in the step of washing the laundry, one or the other direction rotation of the inner tub and the pulsator are repeated for a predetermined number of times.

5           16. The method as claimed in claim 15, wherein the step of rotating the laundry further includes the step of rotating the pulsator to wash the laundry by pulsation of the pulsator after repetition of the one or the other direction rotation of the inner tub and the pulsator for a predetermined number of times.

10           17. The method as claimed in claim 16, wherein the step of rotating the pulsator includes the step of rotating the inner tub having no rotation force of the motor transmitted thereto together with the rotation of the pulsator in a direction opposite to the rotation direction of the pulsator by a principle of action-reaction with respect to the rotation of the pulsator.

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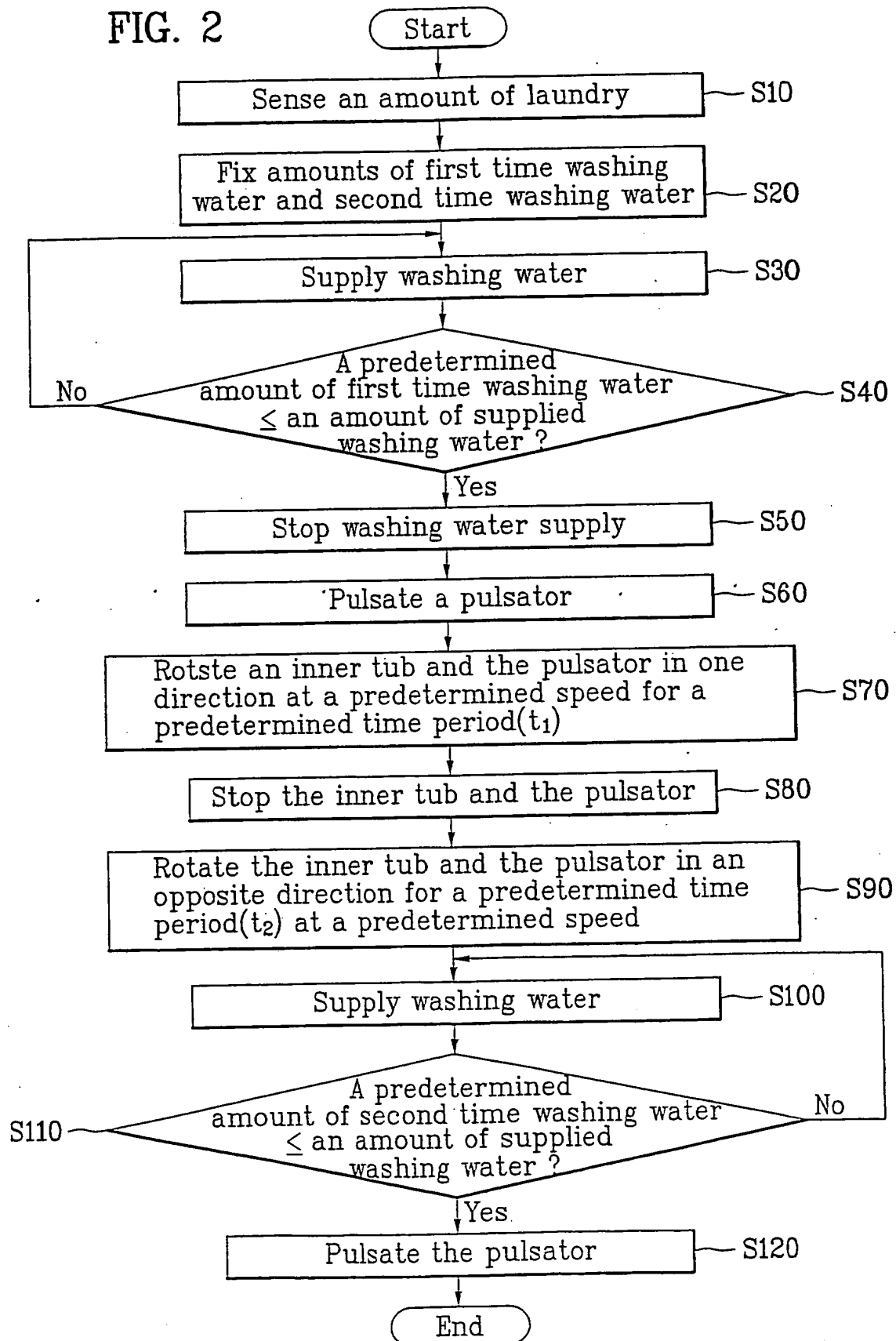
FIG. 1



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FIG. 2



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